Attachment A

Asset Management: Pavement Assessment Annual Update

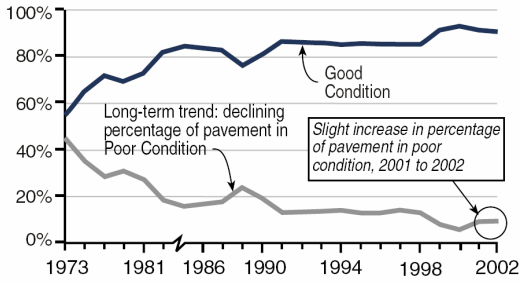
WSDOT maintains approximately 19,200 lane miles (including ramps) of pavement surfaces. The three major pavement types are chip seal, hot mix asphalt pavement, and portland cement concrete (PCC) pavement. Each of these pavement types has an associated pavement life, rehabilitation treatment, and rehabilitation cost. This report is an annual update of information last presented in the *Gray Notebook* for the quarter ending December 31, 2002.

Pavement Condition Update, 2002 Results

According to the 2002 pavement condition survey, the percent of WSDOT pavements in "poor" condition increased slightly in 2002 to 9.3 percent, up from 8.9 percent as reported in the 2001 pavement survey. The rating continues to be dramatically better, however, than the situation in 1971 when the Washington State Pavement Management System was first put in place.

Pavement Condition Trends

Percent of Pavements



Source: WSDOT Materials Lab.

Programming Pavements for Rehabilitation

The table below shows some important facts about the extent and use of the various pavement types, and the success that the state seems to be achieving in directing investment to areas of need.

Over the last biennium, about nine percent of pavement rehabilitation spending has been for chip seal resurfacing. These roads, the cheapest to resurface, constitute about 23 percent of the lane miles but carry only about five percent of the traffic.

Eighty-eight percent of the spending has been for preservation of hot mix asphalt pavements. These roads are 64 percent of the lane miles and carry 71 percent of the traffic.

The PCC pavements are 13 percent of the lane miles, yet carry 23 percent of the traffic. PCC pavements have longer lives than other pavements, but are very costly to rehabilitate, not only in terms of construction money but also in traveler inconvenience from traffic restrictions when pavement work is performed, especially on the major high-traffic corridors. Forthcoming replacement of these pavements will bring big challenges involving funding, engineering and traffic management during construction (see the discussion on PCC pavements later in this section). The state is fast approaching the need to reckon with this looming financial and traffic crisis in pavement management, a story that is not fully revealed by the generally positive picture conveyed by the recent annual surveys of "poor" condition pavements for the entire highway system.

Lowest Life Cycle Cost (LLCC) Program for Pavement Management

The basic principles behind LLCC are rather simple — if rehabilitation is done too early, pavement life is wasted, if rehabilitation is done too late, very costly repair work may be required, especially if the underlying structure is compromised. WSDOT continually looks for ways to best strike a balance between these two basic principles while implementing the practical aspects of pavement rehabilitation programs.

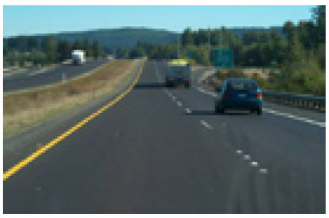
Pavement Type	Lane Miles	% Lane Miles	Annual Vehicle Miles Traveled – 2002 (in billions)		03-05 Dollars Programmed (in millions)		05-07 Dollars Programmed (in millions)	
			Miles	%	$	%	$	%
Chip Seal Pavements A chip seal is a durable surface that provides six to eight years of performance life and has an approximate cost of $12,000 per lane mile.	4,490	23.4%	1.7	5.3%	$19.5	9%	$18.2	9%
Hot Mix Asphalt Pavements Hot mix asphalt pavement surface life between rehabilitation treatments can range from six to 18 years (based on actual pavement performance) and has a cost of $123,000 (due miles) per lane mile, and $156,000 (past due miles) per lane mile.	12,284	64.0%	22.5	71.5%	$181.9	84%	$184.5	91%
Portland Cement Concrete (PCC) Pavements WSDOT has experienced PCC pavement lives ranging from 25 to 45 years and has an approximate cost of $330,000 for dowel bar retrofit per lane mile and $1 million for full replacement per lane mile.	2,410	12.6%	7.3	23.3%	$14.2	7%	$0	0%

Source: WSDOT Systems Analysis and Program Development Office, WSDOT Materials Lab.

Chip Seals

For chip seals, asphalt is sprayed on the existing surface and then covered with a layer of rock chips. The oil becomes solid as it cools. Chip seals are appropriate for low volume roads (less than 2,000 vehicles per day and less than approximately 200 trucks per day). Since the roadways that receive this type of treatment are typically on rural routes, WSDOT has found that pavement rehabilitation dollars seem to be best spent with efficiency of scale when a stretch of rural road mileage is taken together for resurfacing in a single "paver" contract even when the contract includes aging segments not yet "due" together with "past due" segments.

Hot Mix Asphalt



On average, western Washington hot mix asphalt pavement life is 16.5 years, eastern Washington life is 11.3 years (due to severe winter cold and extreme summer heat), and the statewide average is 14.7 years. Hot mix asphalt is appropriate for a broad range of roadways, from lower volume routes (more than 2,000 vehicles per day and more than 200 trucks per day) to interstates with heavy traffic volumes.

These pavements are where the greatest benefits of LLCC pavement management can be realized. In past biennia, there has been some tendency to allocate a share of pavement preservation dollars on a traditional basis by region in addition to dollars programmed strictly by reference to "past due" needs. This has resulted in some distortion away from ideal LLCC results. As of the 2003-05 biennium, this has been corrected by making all regional allocations based on pavement condition and LLCC analysis.

Efficiency Gains for Hot Mix Asphalt Pavements

Hot mix asphalt surface life has improved by 14 percent (statewide) over the last six years, while over the same time period the vehicle miles traveled on asphalt paved roadways has increased by approximately 10 percent. Management of asphalt pavements is an area where WSDOT has succeeded in delivering dramatically improved "bang for the buck" to Washington state taxpayers.

How have WSDOT and its asphalt paving industry contractors achieved this significant efficiency gain in asphalt on state freeways and highways? The keys lie chiefly in the following areas:

- Provision on the paving specification for use of performance-grade binders selected for expected climate and traffic conditions;
- Use of Superpave mix designs keyed to temperature and traffic expectations;
- Improved asphalt pavement repair and asphalt placement techniques;
- Better attention to construction details and inspection, and,
- Increased experience with LLCC rehabilitation programming.

WSDOT is also focusing pavement management efforts on programming more lane miles at a single location, resulting in lower bid prices. The amount of asphalt used for pre-leveling (filling in minor ruts and depressions prior to paving) has also been reduced on WSDOT paving jobs, generally from 600 tons per lane mile to 300 tons per lane mile, resulting in a substantial cost savings. The effect of these efficiency gains, taken together, is that a tax dollar invested in pavement rehabilitation today buys much more than it did just a few years ago.

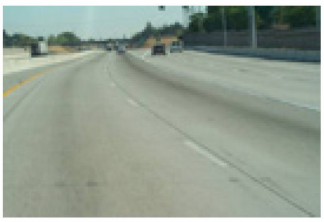
Portland Cement Concrete (PCC)

Existing PCC pavement life ranges from 25 to 45 years. PCC pavement is typically placed on heavily traveled interstate, principal arterial and intersection locations. Most of the PCC pavements historically installed on Washington highways require dowel bar retrofit and diamond grinding (to smooth the pavement surface) 20 to 25 years after construction (due to lack of reinforcing steel at the transverse joints to prevent settlement). It is estimated that a newly constructed PCC pavement will have a pavement life of 50 years and only require diamond grinding in its 25th year due to studded tire wear.

2004 Concrete Lane Miles*

Current Age (Construction or Reconstruction)	Total Lane Miles	Lane Miles Rehabiliated to Date by Dowel Bar Retrofit
0-10	147.1	0.0
11-20	274.0	0.0
21-30	566.8	35.0
31-40	642.0	322.4
41-50	279.1	58.1
51-60	5.0	0.2
61 or more	66.1	0.0
Total	**1980.0**	**415.7**

** Does not include 321 lane miles of bridge sections and 112 lane miles of ramps.*



A matter of concern in the 2002 pavement condition survey is that an additional six miles of PCC pavement were found to have fallen into the "poor" category, raising the PCC "poor" total to 170 lane miles. However, the greatest concern is the potential for a dramatic increase in the poor category as a result of the PCC performance reevaluation in 2004.

The table at left illustrates the number of PCC pavement lane miles currently owned and maintained by WSDOT. Sixty miles of PCC replacement would cost on the order of approximately $60 million *before* taking into account the project costs associated with roadway safety upgrades and stormwater runoff control retrofits. Traffic disruptions associated with rehabilitation or replacement of these pavements is another difficult feature of this looming problem.

Rating Pavement Conditions

WSDOT continues to use a three-part examination system to rate pavement condition:

Pavement Structural Condition (PSC)

A pavement will develop structural deficiencies for two reasons: truck traffic and cold weather. The PSC is a measure based on distress, such as cracking and patching, which are related to the pavement's ability to carry loads. PSC ranges from 100 (best condition) to 0 (worst condition). A roadway should be considered for rehabilitation when it falls within the PSC range of 40 to 60.

Rutting

Rutting is caused by heavy truck traffic or studded tire wear. Ruts deeper than 1/2 inch have the potential to hold water, increasing the risk of hydroplaning for high-speed traffic. A roadway should be rehabilitated when the rut depth is greater than 1/3 inch.

Roughness

The International Roughness Index (IRI) is a procedure to measure pavement ride. A full-sized van, with a laser-measuring device mounted on the front bumper, measures the roughness of the pavement. A roadway should be rehabilitated when the IRI value is between 170 and 220 inches per mile.

Determining When Pavements are "Due"

The Pavement Condition Rating process using the van pictured on the right analyzes and predicts the pavement rehabilitation due period (see the *Gray Notebook* for the quarter ending June 30, 2001 for details). A regional validation process reviews the results and calibrates the ratings if needed. The number of disputed segments varies between 5-10%. Each of the segments in question is then reviewed and any discrepancies are resolved. WSDOT considers the pavement rehabilitation due year in the Pavement Management System to be approaching 100% accuracy.

Pavement Condition Data Collection Vehicle

How Do Washington's Pavements Conditions Compare with National Experience?

FHWA's annual *Highway Statistics* report includes information on pavement condition reported by each of the 50 states and the District of Columbia (based on roughness only). To the right is a snapshot of the 2002 results that shows the number of miles, by state, in poor condition according to smoothness. The total miles reported includes the interstate system and principal arterials owned by the state, cities, and counties, and a sampling of other functional classes. Washington state ranked 16th in smooth roads in 2002 (Washington was ranked 17th in 2001).

The FHWA publication can be viewed at www.fhwa.dot.gov/policy/ohim/hs02/index.htm.

2002 Pavement Smoothness by State

Rank	State	Centerline Miles Reported	Miles in Poor Condition	Percent in Poor Condition
1	Georgia	11,301	34	0.3%
2	Wyoming	4,414	22	0.5%
3	Alabama	7,643	41	0.5%
4	North Dakota	6,180	53	0.9%
5	Minnesota	11,658	108	0.9%
6	Nevada	2,959	33	1.1%
7	Kentucky	5,192	76	1.5%
8	Florida	10,898	160	1.5%
9	Kansas	8,851	183	2.1%
10	Arizona	4,065	86	2.1%
11	Idaho	3,860	93	2.4%
12	Maine	2,391	60	2.5%
13	Montana	6,927	179	2.6%
14	Utah	3,676	120	3.3%
15	Alaska	1,800	62	3.4%
16	**Washington**	**5,396**	**194**	**3.6%**
17	South Carolina	6,791	260	3.8%
18	New Hampshire	1,375	54	3.9%
49	California	20,634	5,437	26.3%
50	Massachusetts	3,290	1,182	35.9%

Source: Highway Statistics 2002, *U.S. Department of Transportation*